ABSTRACT

A modulation apparatus is disclosed that enables great improvements in signal transmission rate in a limited frequency band as compared with conventional modulation schemes. Modulation apparatus 100 has first and second frequency-increasing SSB modulators 110 and 120. The modulators 110 and 120 are configured to have respective carrier frequencies with a difference by a frequency corresponding to the reciprocal of the symbol rate (i.e. fundamental frequency of the input symbol). Adder 130 combines a LSB signal obtained from the SSB modulator 120 set for a higher carrier frequency, and a USB signal obtained from the SSB modulator 110 set for a lower carrier frequency to obtain a modulation signal.

FIG.3

1 2 INTERPOLATION

3 6 DELAY

4 5 HILBERT FILTER

9 10 PULSE SHAPING FILTER

FIG.4

MULTIPLEXING

FIG.5

100 MODULATION APPARATUS

111 121 HILBERT TRANSFORM

FIG.7

200 PHASE-SHIFT TYPE SSB MODULATOR

201 DELAY

202 204 BALANCED MIXER

203 HILBERT TRANSFORM

FIG.11

300 DEMODULATION APPARATUS

FIG.15

EMBODIMENT

FIG.16

BALANCED MIXER

FIG.18

NEW Q-AXIS SIGNAL

NEW I-AXIS SIGNAL

FIG.19

400 MODULATION APPARATUS

403 405 DELAY

411 421 431 441 HILBERT TRANSFORM

FIG.20

500 DEMODULATION APPARATUS

FIG.21

600 DEMODULATION APPARATUS

FIG.22C FIG.23C

ALIAS REGION

FIG.24

REAL PART OUTPUT FROM FFT

611a I-AXIS SIDE LOGIC COMBINING JUDGMENT

IMAGINARY PART OUTPUT FROM FFT

611b Q-AXIS SIDE LOGIC COMBINING JUDGMENT